Architectural Testing, Inc.
37483 Interchange Dr., Farmington Hills, MI 48335
Phone: (248) 957-9911

March 12, 2021

Mr. Daniel Stine
President
Sustainable Energy Engineering
1509 Genesee Dr.
Royal Oak, MI 48073

RE: Visual and Moisture Roof Pre-Design Survey
Canton Public Library
1200 S. Canton Center Rd.
Canton, MI 48188

Dear Mr. Stine:

In accordance with our current contract, Intertek has completed the pre-design survey of the older ballasted EPDM roofing sections at the Canton Library Building located at 1200 S. Canton Center Road, in Canton, Michigan.

Pre-Design Survey Summary

On March 5th, 2021 a pre-design field visit of the older ballasted EPDM roofs was performed at the Canton Library. The entire library building roof totals approximately 55,000 square feet. The original building was approximately 35,000 square feet and in 2001 there were some building additions that totaled about 21,500 square feet. The older "original building" roof system was replaced around 2008 and this survey was to focus on the nearly 20 year old sections of roofing from the 2001 building addition.

The 2001 addition portions of the library roof are ballasted EPDM single ply roof membranes. There is basically a west addition, a south addition and an east addition. The west addition is approximately 7,000 square feet, the south addition is approximately 3,650 square feet (two roof sections, 3,000 sf and 650 sf) and the east additional section is the largest at approximately 10,700 square feet.

The ballasted EPDM roof systems have markings that show them as 60 mil Carlisle membrane systems. Cores taken during the March 5th visit found the three largest areas where there was a single layer of 3.0 inches of rigid isocyanurate foam board and the remaining small area on the south of the building to have two layers of 1.5 inches of rigid foam. In a further search of Google Earth, it indicates that the smaller 16'x40' south addition roof section on the south side was yet a second building addition that was added between 2001 and 2004, thus explaining the minor difference in insulation materials in the system.

Based on the cores and the observations, all of these building addition roofs have a 1.5" deep steel ribbed roof deck and there appears to be positive slope for drainage built into the structural deck framing (approximately 1/8" to 1/4" per foot. Most areas drain to interior roof sumps, but the small roof area of the second building addition drains to a perimeter scupper.

The chart below shows the roof areas, deck type, insulation and membrane system for simplified review. The assemblies listed are based on the roof cores that were made.

Roof Area	Roof Core Location #*	Approx. Size (SF)	Deck Type	Insulation	Roof System
West Area (Section 1)	6, 7, 10, 11 and 12	7,000	Steel Deck	One layer 3.0" ISO loose laid	Ballasted 60 Mil non-reinforced EPDM
South Larger Area (Section 2)	2, 3, 4, 5, 13 and 14	3,000	Steel Deck	One layer 3.0" ISO loose laid	Ballasted 60 Mil non-reinforced EPDM
South Smaller Area (Section 2)	1	650	Steel Deck	Two layers 1.5" ISO	Ballasted 60 Mil non-reinforced EPDM
East Area (Section 3)	8, 9, 15, 16, 17 and 18	10,700	Steel Deck	One layer 3.0" ISO loose laid	Ballasted 60 Mil non-reinforced EPDM
		21,350			

(*Cores #1 through #9 were taken during the visual survey, Cores #10 through #18 were taken during the IR)

As a supplement to the visual roof survey, an infrared roof moisture survey was performed to identify if there is good indications that the existing roof insulation is in a dry enough condition to be salvaged and potentially recovered as part of the long term roof renovation design. The infrared survey was completed on the evening of Tuesday, March 9th, 2021. While ballasted roof systems are sometimes a challenge to scan with IR equipment, the effort generally will find large areas of significant moisture accumulation but may not find small areas or just damp insulation.

The results of the infrared moisture survey scan found no apparent significant areas of heat loss that would suggest wet insulation below the ballasted roof sections. Some areas of heat loss were noted along the roof edges suggesting some air gaps that may allow heat to flow where the insulation and wood nailers meet. A number of probes were taken during the infrared survey to verify that the insulation was dry to the touch at those locations. All of the probed locations were found try to the touch. While we were on site scanning the ballasted sections, we scanned the 2008 roof areas which have a white thermoplastic roof membrane system in place. The results of the infrared moisture scan on those white roof membrane areas found no apparent significant areas of heat loss that would suggest wet/saturated insulation in those areas. No probes were taken in the 2008 roof areas as those are understood to still be under a Johns Manville manufacturer's warranty.

Some occasional roof leaks have been reported at in the older ballasted EPDM roof areas. During our interviews we were informed that past repairs have been done to find and patch leaks as they were identified. During the field survey we found three small membrane tears near the roof edge what would obviously allow water to enter the roof system. To assist the Owner, we applied temporary patches to those areas. With the single layer of insulation and with steel roof deck, it is very common that even when there are holes or seam failures that allow water to get past the EPDM membrane, that the water can then travel and drain through the insulation layers and down into the steel deck and into the building without having significant moisture trapped or retained in the insulation material.

The slope on these ballasted EPDM roof sections was measured to be approximately 1/8" to 1/4 inches per foot. The slope is generally a 4 way slope to the interior drains. No significant amounts of ponding water were noted during the visual survey which would indicate that drainage is sufficient.

The existing metal edging is the original copper metal. The copper metal is in fair condition and could be left in place and new metal could be installed over the existing. In looking at what was done with the 2008 roofing, it appears that the original copper was left in place and a new snap on metal was installed. These ballasted roofs could have similar installations so as to nearly match the appearance of the 2008 roof edge and provide some continuity of appearance.

These ballasted EPDM roof sections have a normal amount of rooftop equipment, including both small curbs as well as large HVAC units. There are some platform screen walls with sloped metal panels around the larger rooftop units. Based on the observed conditions there does not appear to be any significant costs related to installing new flashings to either the small or the large curbed units. The platform screen wall metal panel roofs could remain.

At the perimeters, the existing roof system is nearly flush with the existing perimeter metal. This will require that additional wood blocking to be installed at the perimeters so as to meet or exceed the elevation of any recovery roof insulation that is installed. Where the ballasted roof abuts the white 2008 roofing there are raised roof section dividers, which for the most part can remain. The sheet metal on those dividers will either need to be removed and reset or replaced during the planned roof renovation.

While much of the ballasted roof has normal light foot traffic to maintain the roof, there are localized areas where heavier foot traffic occurs. In those heavier trafficked areas, the Owner should consider installing walkpads, or can choose to install a more durable insulation recovery board and thicker membrane so as to make those areas even more durable and resistant to foot traffic.

In discussions with the facility, they did not believe that the reroofing work would require the building to be shut down. There are drop ceilings in place over much of the building and typically reroofing in such conditions would not require the building to be closed. We also don't believe that electrical conduit or other wires are routed in deck flutes (which may be penetrated by new roof system fasteners). If this condition does exist, it would be isolated.

Based on the age and condition of these older ballasted EPDM roofs, it is our opinion that they should be either recovered or replaced. Continued attempts for cost effective long term repair do not appear possible.

A preliminary roof plan for the facility is provided and appended to this report. That plan shows the building areas planned for rehabilitation.

Recommendations and Preliminary Design

In summary, the existing ballasted EPDM roof system is at the end of its useful service life. While the existing ballasted roof system could be "patched" and could perhaps provide limited service for 1-3 more years, it would be our experience that repair of this older roof system will not be viable long term and that leaks are likely to become more common and more of a problem over the next few years (even with repairs).

Based on the existing observations and conditions, it would be our recommendation that the older ballasted roof system be removed down to the surface of the existing rigid insulation. The existing insulation would then be repaired on an "as needed" basis and a new recovery roof system with new cover board insulation be installed. With the new insulation, it will be necessary to install new wood blocking to select curbs as well as the perimeter roof edges to meet or exceed the elevation of the new roof insulation.

The anticipated construction time to complete this work would range between 3 and 6 weeks depending on the size of the crew and other factors that are not knowable at this time.

The existing river washed rock ballast on the building could be salvaged and perhaps utilized as landscape rock somewhere in the City of Canton. Approximately 20 tons of stone ballast could be salvaged is that is something that the City/Township would like to have happen. The rock could be placed in a pile somewhere on the property for later relocation by the City/Township. Generally stockpiling the old ballast in this way is no additional cost to the project and can sometimes be a small savings depending on trucking and disposal costs for these rock materials.

The following summaries the scope of work for the new roof system:

1. Complete removal of the existing river washed rock. The rock can be stockpiled on site, or can be disposed of off site.
2. Complete removal of the existing 60 mil EPDM membrane and flashings.
3. The work can include the removal of the edge metal, or the existing edge metal can be substantially left in place. Leaving the old metal in place may save a nominal amount of initial costs (approximately $500 to $2,500).
4. Inspect and replace on a unit price basis any "wet or damaged" insulation. Based on the IR scan, we would perhaps expect 2-5% of insulation replacement as being necessary (mostly due to damage from roof traffic).
5. Inspect and replace any deteriorated or damaged wood nailer.
6. Install new wood blocking to meet or exceed the new recovery insulation thickness.
7. Apply low rise foam or other means to better seal the transition from the decking to perimeters, curbs, and transitions to limit any direct air paths into the new roofing system.
8. Install new recovery insulation, mechanically attached through the salvaged insulation to the steel roof deck. With the existing insulation providing an approximate R-value of 15, you can choose to install either a thin "minimum thickness" cover board to support the new membrane, or you can choose to install a thicker insulation board for the purpose of adding R-value. The records from the 2008 project indicate that a 1.5" board was installed, which would add an R of approximately 8. The addition of a 1.5" board would also match nicely with adding a single new 2x blocking at the perimeter edges and it would provide for the same system R-value as is on the 2008 roof. Please know that the current

recommendations are for buildings to have R-25 as a minimum. Because you would be recovering the roof, you are NOT required to meet the R-25 minimum assembly. To meet R-25 you would need to install a minimum 2" thick recover board. And a 2.5" recover board would provide for R-30. The new cover board should have the joints offset from the existing single layer in order to meet good roofing practice.

9. Install new white thermoplastic roof membrane sheet, fully adhered to closely match the system installed in 2008. The sheet could be a nominal 60 mil membrane or can be "enhanced" to an 80 mil thickness for even greater durability. This system will provide an estimated 20+ year life expectancy.
10. The existing roof drains would be cleaned and salvaged for re-use.
11. New metal edging would be installed and new edge membrane flashings would be installed.
12. New walkways would be installed to allow for planned roof maintenance foot traffic.

Budget

Based on the work described above, the following are preliminary estimated construction budgets:

1.	Roof Recovery with 1.5" insulation and 60 mil fully adhered thermoplastic roof system ……	$215,000 to $270,000
2.	Added costs for thicker 2.5" insulation ….	$ 25,000 to $ 35,000
3.	Added costs for 80 mil system (if entire roof) …..	$ 20,000 to $ 25,000
4.	Contingency costs (~10%) ……	$ 20,000 to $ 35,000
	TOTAL BUDGET FOR PROJECT ……..	**$280,000 to $365,000**

Budget assumes roof replacement is performed as one large project in 2021.

The standard available warranties for a fully adhered thermoplastic membrane system would be 20 years. Longer duration warranties may be available with the thicker 80 mil membrane system.

While a fully adhered white thermoplastic membrane would be our recommended recovery system, please know there are two other options. The first is a mechanically attached membrane, using the same thermoplastic sheet but rather than gluing it down it is secured with fasteners. The life expectancy for this system is estimated at 15 to 20 years and may represent a savings of around $25,000. The second option is installing a ballasted system, essentially similar to the one you have now (we don't recommend this unless budget is an issue). That work scope would be the lowest anticipated initial cost and with that roof system selection you could salvage the existing stone ballast and use the old EPDM as a protection sheet. That lowest cost roof system scope would be to temporarily relocate the stone, strip the EPDM, repair wet insulation, install a low cost cover board, install a new 60 mil EPDM membrane (loose laid) and install the salvaged ballast over a protection sheet. This low cost system would still have new metal. The approximate savings for a 60 mil ballasted EPDM system as compared to the recommended fully adhered 60 mil thermoplastic system would be approximately $50,000. A ballasted 60 mil EPDM system will be able to offer a minimum 15 year system warranty and some manufacturer's may be willing to offer 20 year warranties for this system. We would expect this system to last 15 to 20 years, similar to your existing roof.

Please know that no sampling or testing for asbestos was performed as part of this survey and pre-design work. We didn't identify any materials that would normally be associated with containing asbestos. We don't expect to uncover any products that may contain asbestos on this project.

Intertek can begin to prepare a Bid Document upon your direction to proceed and upon a selection of the desired scope of work.

Sincerely,

INTERTEK

Christopher B. Cogan, CDT
Department Manager
Building Science Solutions

Paul M. Majkowski, P.E., RRC
Principal Roof Consultant

Enclosures:

- Appendix A – Photographs
- Appendix B – Thermograms
- Appendix C – Roof Plan Sketch

1. General view of East Area roof, looking south. Aggregate surfaced EPDM.

2. Another view of East Area roof, looking north. The sloped mechanical unit screen wall roof visible on left.

3. Holes found in the NW corner of the east area. The wood blocking at the edge visible through the holes.

4. Intertek installed repair patches over these holes.

5. View of a typical core in the main roof areas. A single layer of 3" thick rigid isocyanurate foam found over a steel roof deck.

6. View of the roof core from the smaller south building addition where two layers of 1.5" foam exist.

Photographs 1-6

7. View of the smaller south building addition, looking northwest.

8. View of smaller south building addition, looking southwest. This roof drains to a scupper at the south wall.

9. View of the typical raised perimeter metal edge.

10. View of a typical raised roof edge. The wood blocking is approximately 13 inches wide and supports the EPDM roof.

11. View of the inside/underside of one mechanical screen wall area.

12. Another view of large rooftop penetrations and some limited spacing between the units.

Photographs 7-12

13. View of equipment sleeper supports. Reroofing should be possible without having to lift the large units.

14. An existing pyramid skylight. This skylight should also be able to be reroofed without having to lift and reset the skylight and frame.

15. Most gas and/or electrical conduit is high enough to remain. Some areas may have to be lifted, depending on the thickness of the recovery insulation.

16. View of one location where the conduit goes through an area divider to the 2008 roof system.

17. Another view of the existing conduit and conduit supports on the ballasted roof. With the replacement roof, newer style supports could be added that may be better systems than simple wood blocking supports.

18. View of how roller supports were installed during the 2008 work and a view of the metal edge assembly on the 2008 work. It may be desired to match the look of the metal.

Photographs 12-18

19. Typical existing 4” roof drain on the larger roof sections.

20. Typical Portals Plus cap, which may be able to be salvaged and re-used during roof renovation.

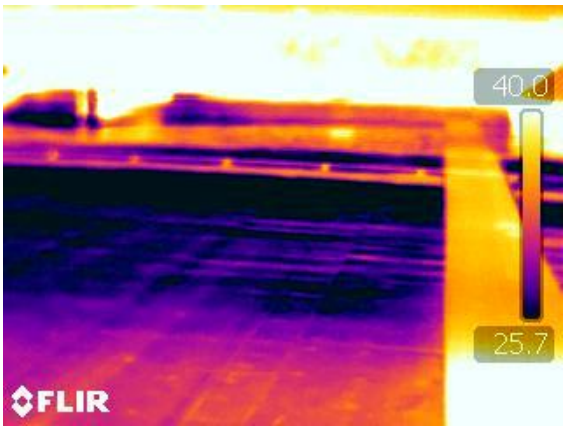
21. Localized HVAC unit on wood sleepers. Should be able to be raised a few inches to sit on newer sleepers and pads with the new roof system.

22. View of a typical roof edge.

23. Close up measurement of the existing metal. Existing metal is slightly out from brick and is approximately 5 inches in face dimension.

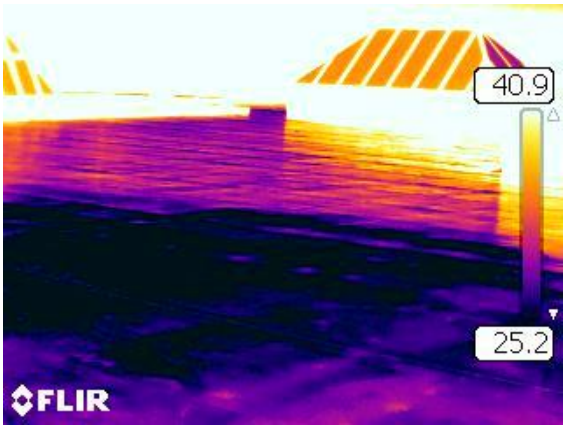
24. Typical existing walk pads. With replacement roof new safety yellow walk pads could be installed, similar to those installed in 2008.

Photographs 19-24



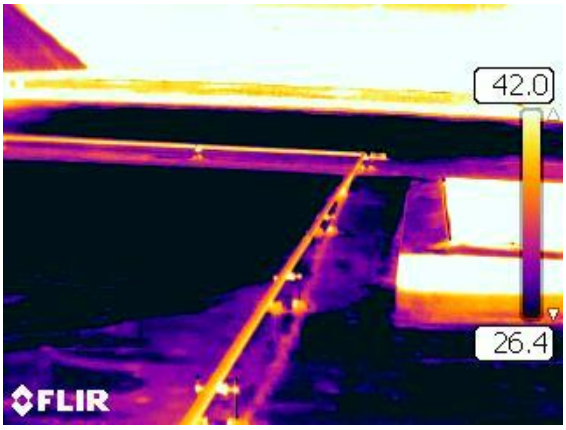
1. Image 1. Walkway visible (as would be normal) in one of the 2008 smooth surface areas. No localized heat images that would be suspect of representing wet insulation.

2. Image 2. Another view of the 2008 smooth roof. Walkway visible (as would be normal). Curbs and pipes also visible (as normal). No localized heat images that would be suspect of being wet insulation.

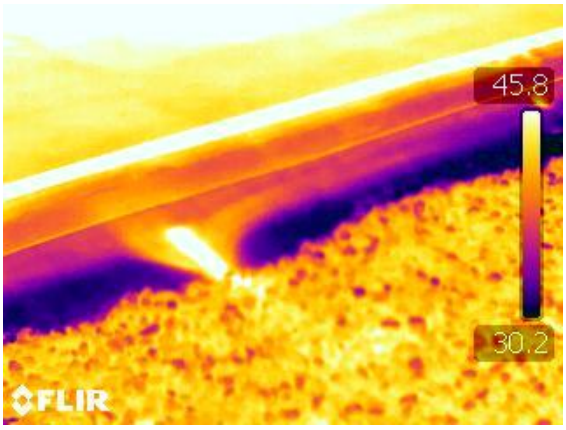


3. Image 3. A 3rd look at a smooth 2008 area roof. No localized heat images that would be suspect of representing wet insulation.

4. Image 4. A 4th look at a smooth 2008 area roof. No localized heat images that would be suspect of representing wet insulation.

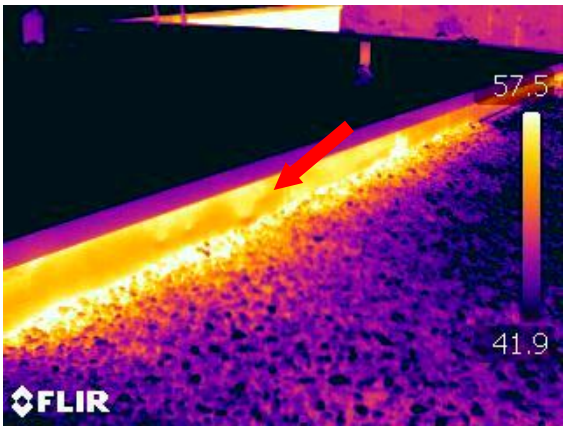


5. Image 5. One more smooth roof. No localized heat images that would be suspect of representing wet insulation. Conduits visible.

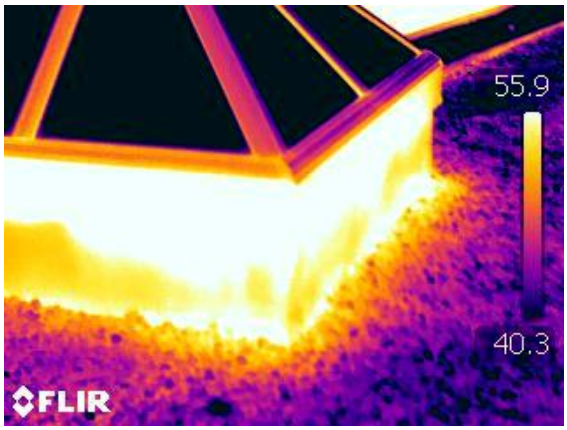


6. Image 6. View of a “ballasted roof edge”. See the heat from the rocks. Gap between insulation board and/or nailer allowing heat loss.

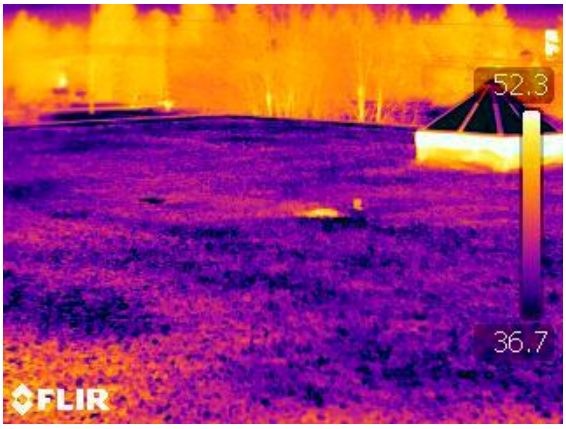
Photographs 1-6



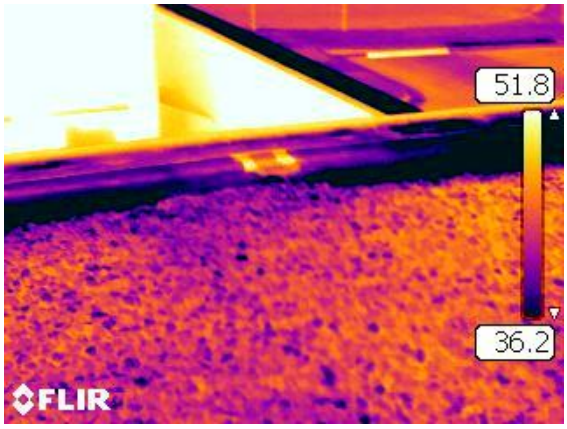
7. Image 7. Heat loss at the raised area divider curb. This is not believed to be due to wet insulation, but perhaps air leakage from the insulation to the wood curb.



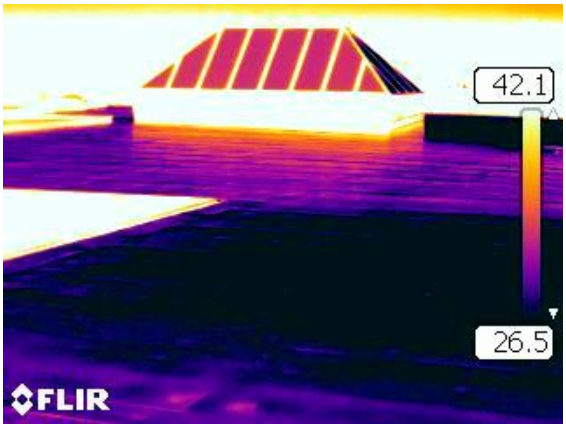
8. Image 8. Heat loss at the curb of the skylight. No obvious heat images in the ballasted system.



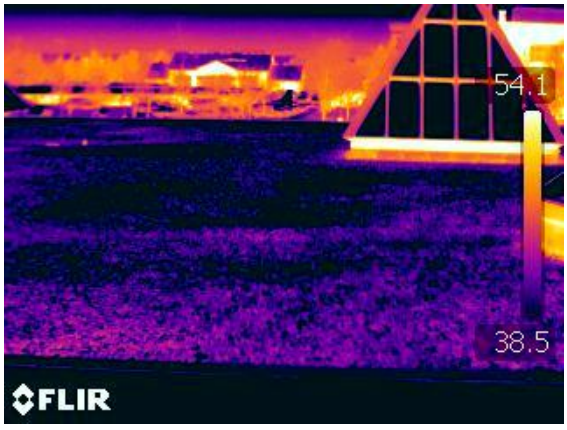
9. Image 9. General view of the ballasted roof with no localized heat images representing “wet insulation”. The roof drain is visible as the bright spot in center of roof.



10. Image 10. Another example of some localized heat loss at joints in the perimeter wood nailers. This is on a ballasted roof section.

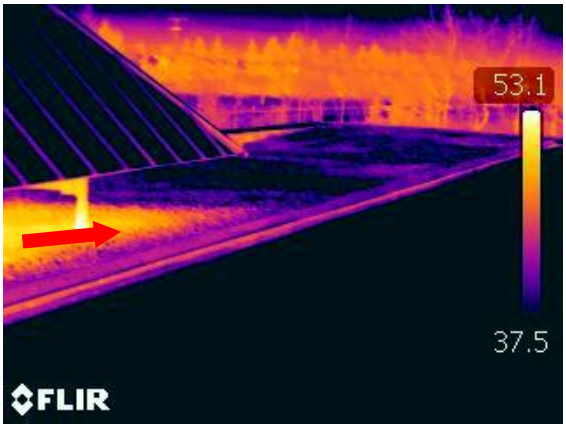


11. Image 11. No heat loss in the field of the white roof suggest wet insulation. (The white roofs have a smooth appearance while the ballast has a mottled appearance).

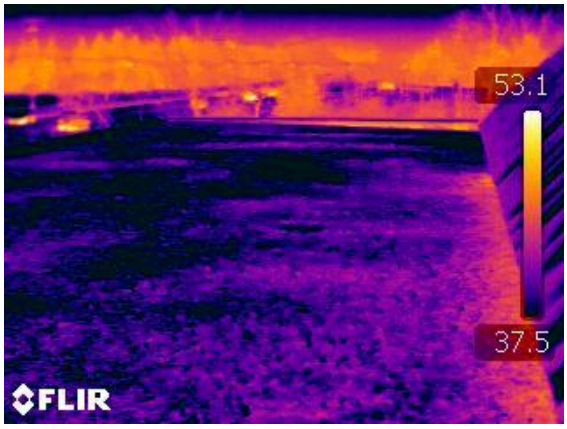


12. Image 12. Another view of a large section of ballasted EPDM with no observed heat loss areas.

Photographs 7-12



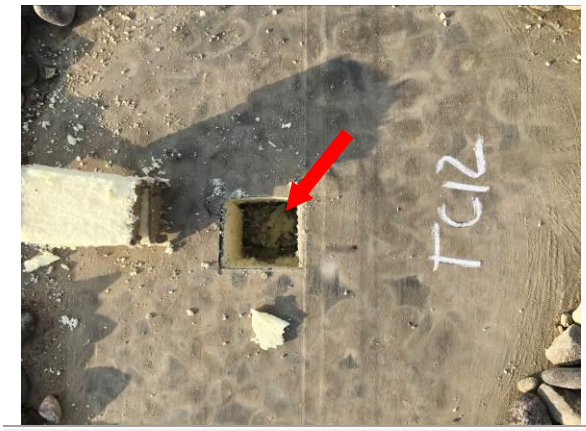
13. Image 13. The rock ballast is “warmer” under the screen wall, which is normal as the heat is held in place by the overhang condition and the heat from the unit.



14. Image 14. No observed heat images that would indicate wet insulation in this ballasted section.

15. Photo of Test Cut #10. Insulation found dry to touch.

16. Photo of Test Cut #11. Insulation found dry to touch.



17. Photo of Test Cut #12. Insulation found dry to touch.

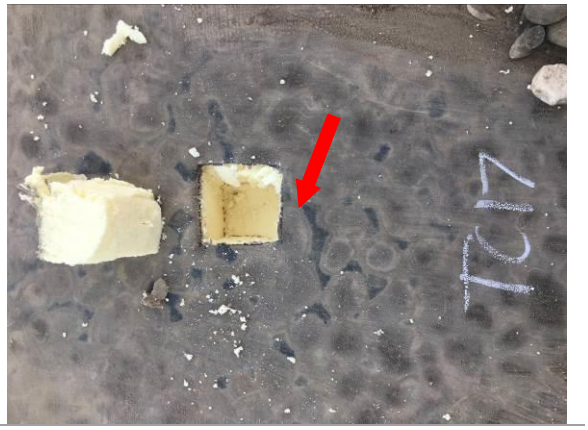
18. Photo of Test Cut #13. Insulation found dry to touch.

Photographs 12-18

19. Photo of Test Cut #14. Insulation found dry to touch.

20. Photo of Test Cut #15. Insulation found dry to touch.

21. Photo of Test Cut #16. Insulation found dry to touch.



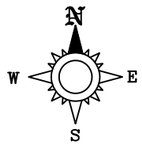
22. Photo of Test Cut #17. Insulation found dry to touch.

23. Photo of Test Cut #18. Insulation found dry to touch.

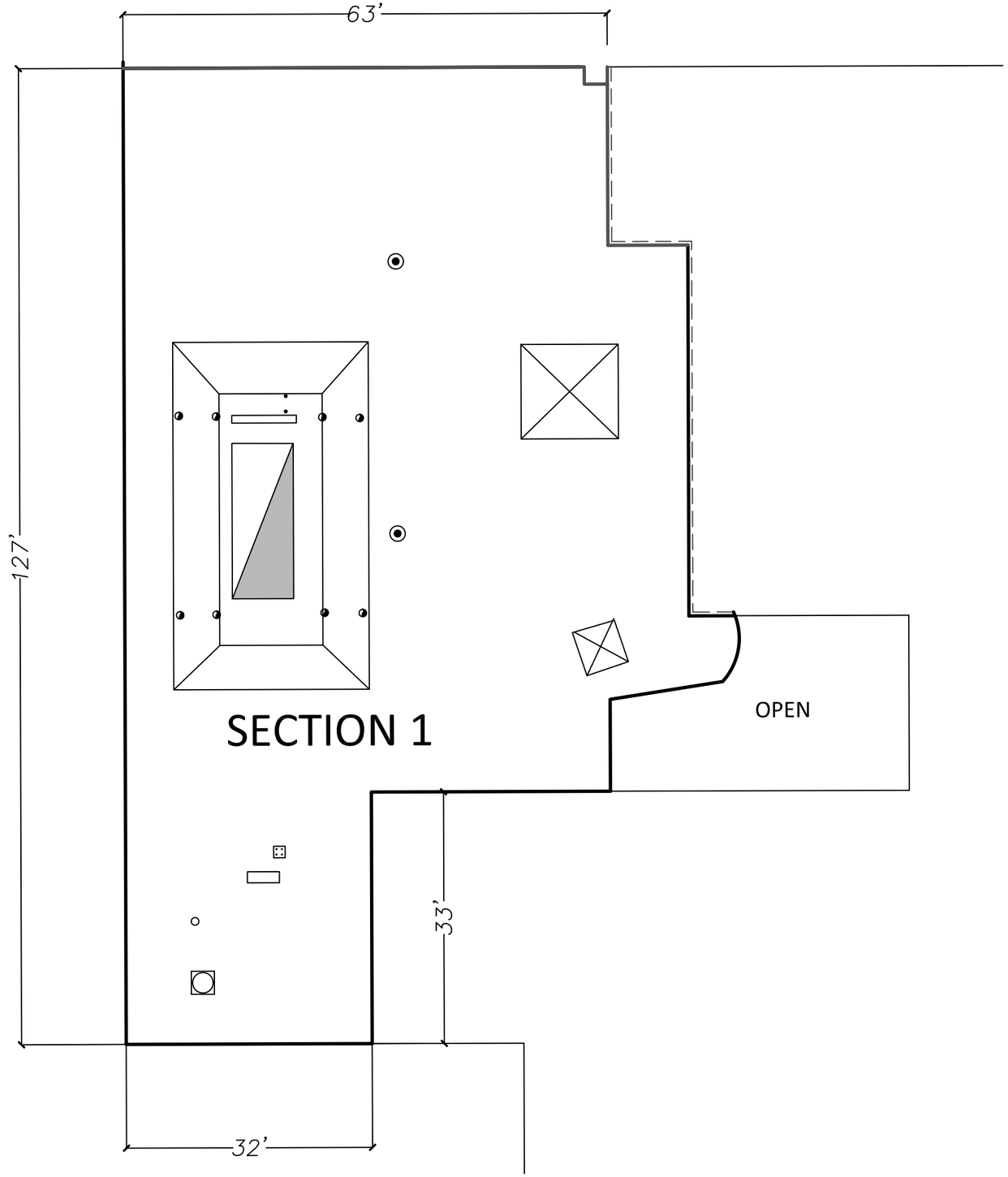
Intentionally Blank.

24. Intentionally Blank

Photographs 19-24

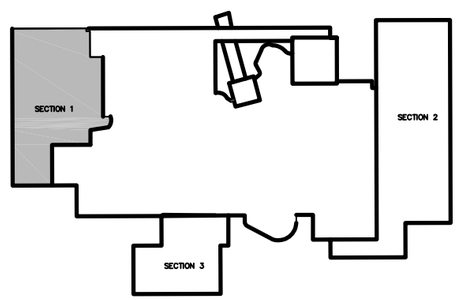


ROOF AREAS	
SECTION	SQ. FT.
1	7,660
2	10,871
3	4,248
TOTAL	22,779



SYMBOL LEGEND

	PLUMBING VENT (SOIL STACK)
	HOODED VENT
	AIR CONDITIONER
	PITCH PANS
	PIPE PENETRATION
	DIVIDER WALL
C-X	CORE LOCATION
	GAS LINE
	EXHAUST FAN
	ROOF DRAIN
	SUPPORT PIPE



KEY PLAN

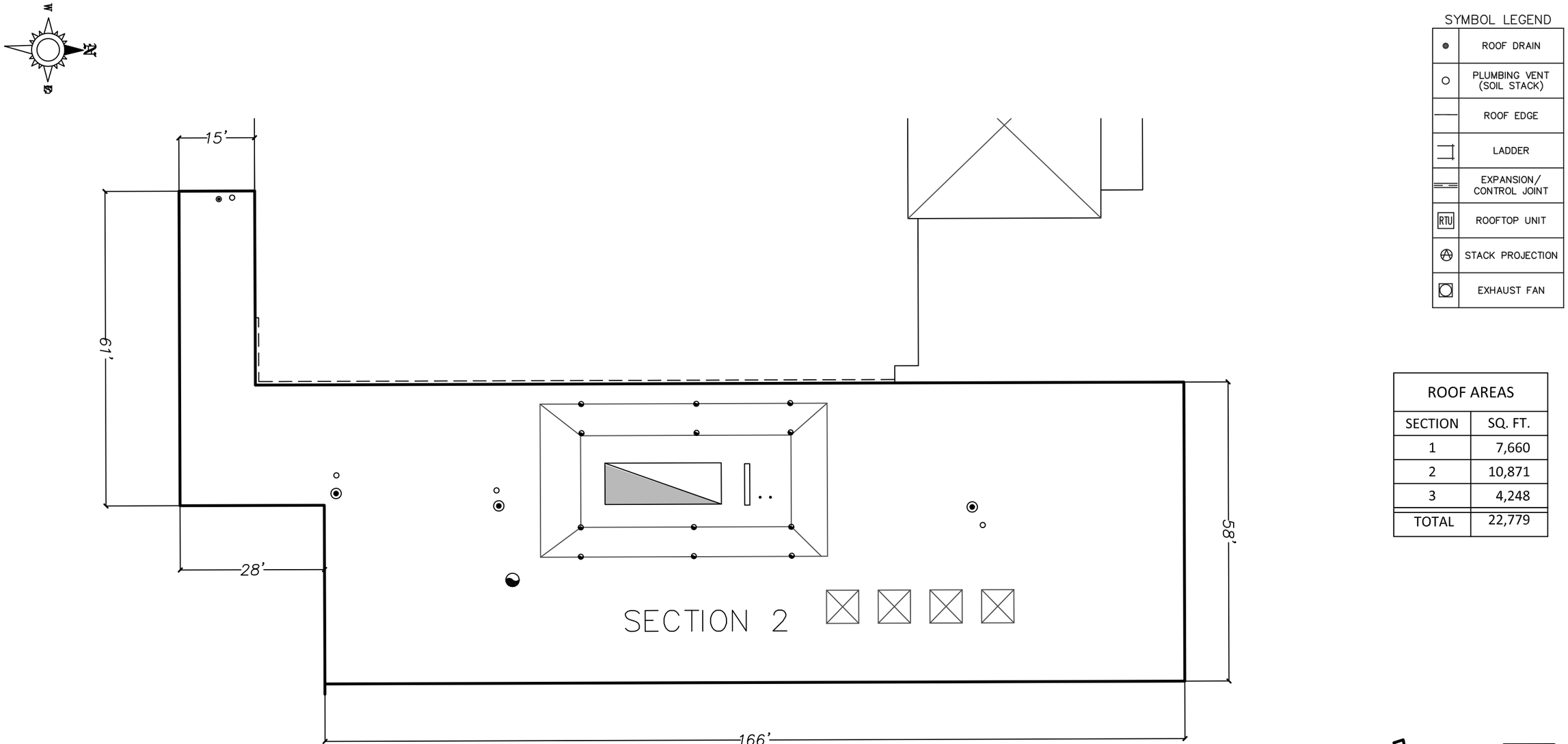
01
RP-1

SECTION 1 ROOF PLAN

SCALE: 1/16'"=1'-0"

Building Science Solutions
Building and Construction
37483 Interchange Drive · Farmington Hills · Michigan · 48335 · Tel 248.957.9911

PROJECT NAME:	DRAWN BY:	DATE:	DRAWING NO.:
CANTON PUBLIC LIBRARY	DRS	2/28/2021	RP 1
TITLE: SECTION 1 ROOF PLAN	PROJECT MGR.: C.COGAN	PROJECT NO: M0308	



SYMBOL LEGEND

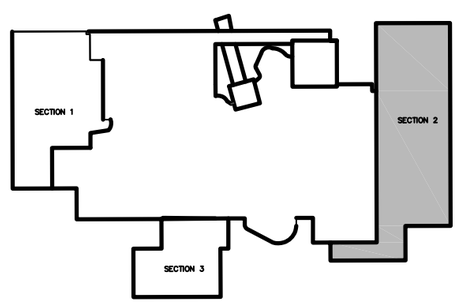
●	ROOF DRAIN
○	PLUMBING VENT (SOIL STACK)
	ROOF EDGE
	LADDER
	EXPANSION/ CONTROL JOINT
RTU	ROOFTOP UNIT
	STACK PROJECTION
	EXHAUST FAN

ROOF AREAS	
SECTION	SQ. FT.
1	7,660
2	10,871
3	4,248
TOTAL	22,779

01 RP-2

SECTION 2 ROOF PLAN

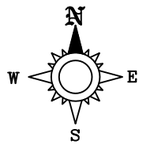
SCALE:1"= 20'

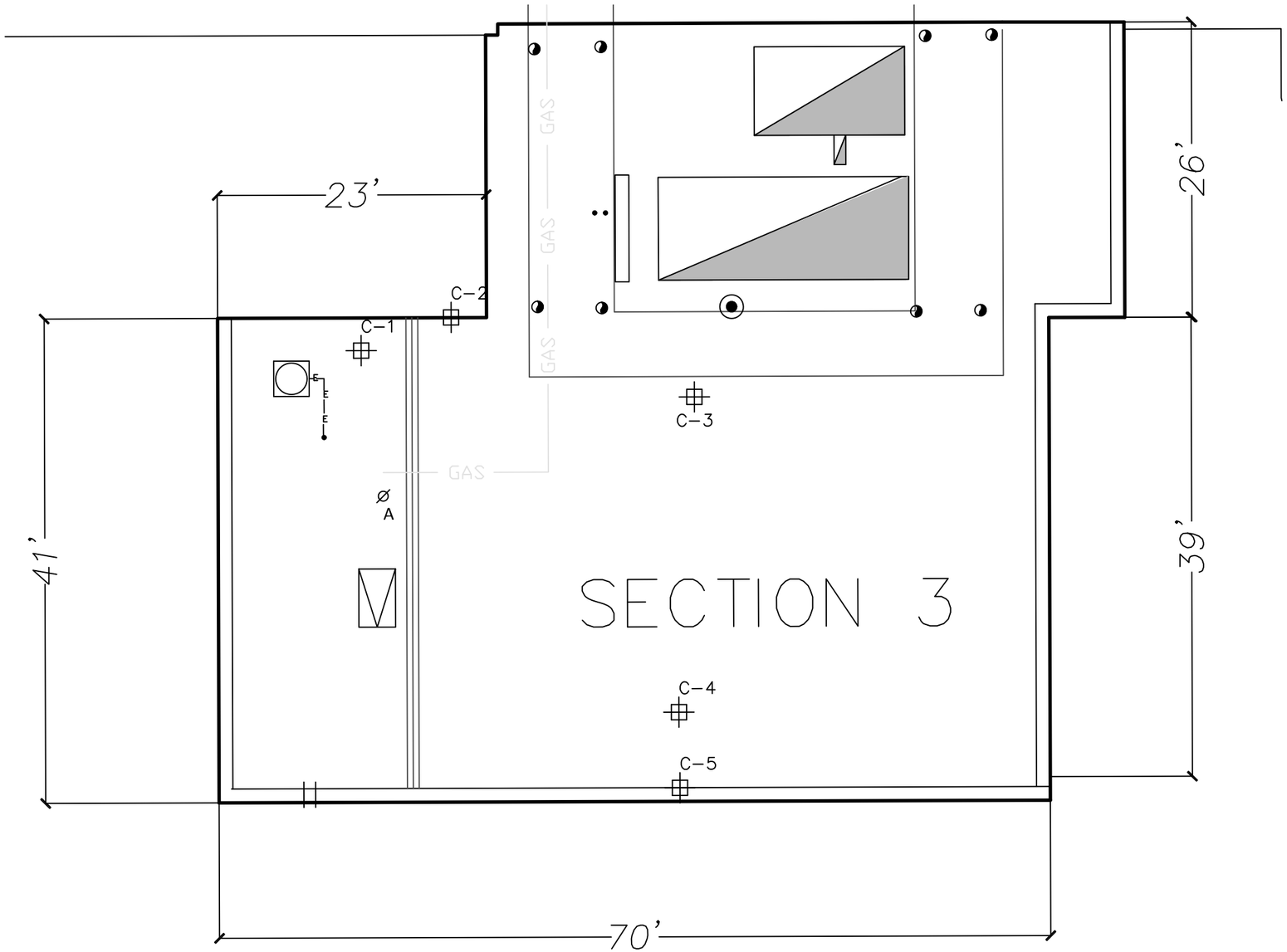


KEY PLAN

Building Science Solutions
Building and Construction
37483 Interchange Drive · Farmington Hills · Michigan · 48335 · Tel 248.957.9911

PROJECT NAME: CANTON PUBLIC LIBRARY		DRAWN BY: DRS	DATE: 2/28/2021	DRAWING NO.: RP 2
TITLE: SECTION 2 ROOF PLAN		PROJECT MGR.: C.COGAN	PROJECT NO: M0308	





01
RP-3

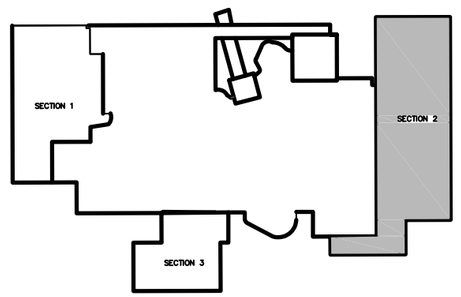
SECTION 3 ROOF PLAN

SCALE: 3/32'"=1'-0"

SYMBOL LEGEND

○	PLUMBING VENT (SOIL STACK)
Ø	HOODED VENT
	AIR CONDITIONER
■ ●	PITCH PANS
●	PIPE PENETRATION
	DIVIDER WALL
C-X	CORE LOCATION
	GAS LINE
	EXHAUST FAN
	ROOF DRAIN
	SUPPORT PIPE

ROOF AREAS	
SECTION	SQ. FT.
1	7,660
2	10,871
3	4,248
TOTAL	22,779



KEY PLAN

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